IIT KHARAGPUR

DIY PROJECT REPORT TEAM-2(II)

20 21

ABSTRACT

The main objective of this project is to simplify the task of cleaning. Cleaning is essential work in every household or any other place. Since this work requires a lot of time and human energy in today's time it is not feasible. To solve this problem we have build a smart vacuum cleaner robot to automatically clean the floor without human intervention.

Not only household but also places where cleaning is dangerous to human life , automation is a great solution. Our Robot is operated by IOT and arduino programming, It uses vacuum cleaner, motor, Ultrasonic sensors and IR sensors to clean the floors automatically.

We just have tried to create a small version of it to implement in domestic use only.This model could be evolved with time and put to greater use.

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INTRODUCTION

Now a days household of today are becoming more smarter and automated. Domestic robots are entering in the homes and people daily lives. These robots are making our daily life more convenient. Vacuum cleaning robots are one of them. It is an entirely automated machines that allows for stress free cleaning of your home with minimal human intervention. These devices contain various sensors which allow it to clean automatically.

Cleaning is a important work approximate every place. Sometimes we assign people and pay money to them for cleaning our house. In the present scenario all the members of our family are busy with their work and not getting proper time to clean the house. The cleaning robots help to clean and mop the floor. This also cuts down the labor used in factories for cleaning floor. Mainly it is used in when large areas are required to clean. In some areas like nuclear plants and chemical industries the dangerous radiation, chemicals can make human sick However these robotic cleaners very costly which cannot be afforded by common people.

The above stated facts are the main motivation of the project. So we tried to create a cheap and affordable robotic vacuum cleaner by using Arduino programming

OVERALL PROGRESS OF PROJECT

Initially, we started with the communication between the group members with bunch of models of our view . By overviewing all the projects all have decided to make vacuum cleaner robot .Hence with the work distribution we started making model in "TINKERCAD" . This model was later used for various combinations and structures of source code . Started collecting the components required for model.

We researched on functioning of Adruino mini and various other components and then made a source code . There were a lots of bugs faced during the formation of source code. Overcoming the bugs finally the source code was completed.
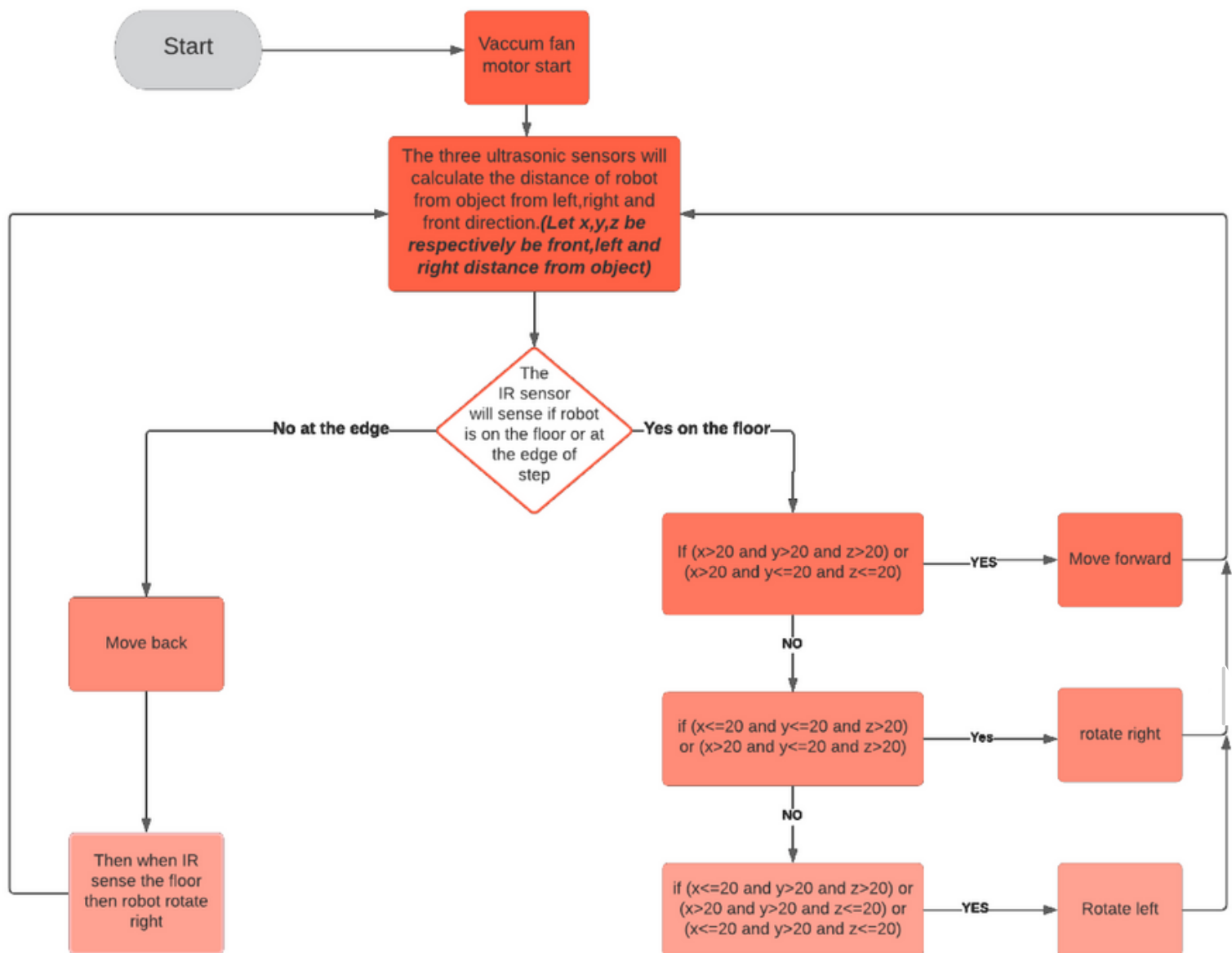
With the help of tinkercad and source code we started making model .The problem faced regarding modelling was balancing of robot and large size of adruino uno which later replaced by adruino mini .
Later on by overwhelming all problems in model we started designing the model in "Freecad" model . Since their were issues in freecad model but later it were solved and finally freecad madel is ready.
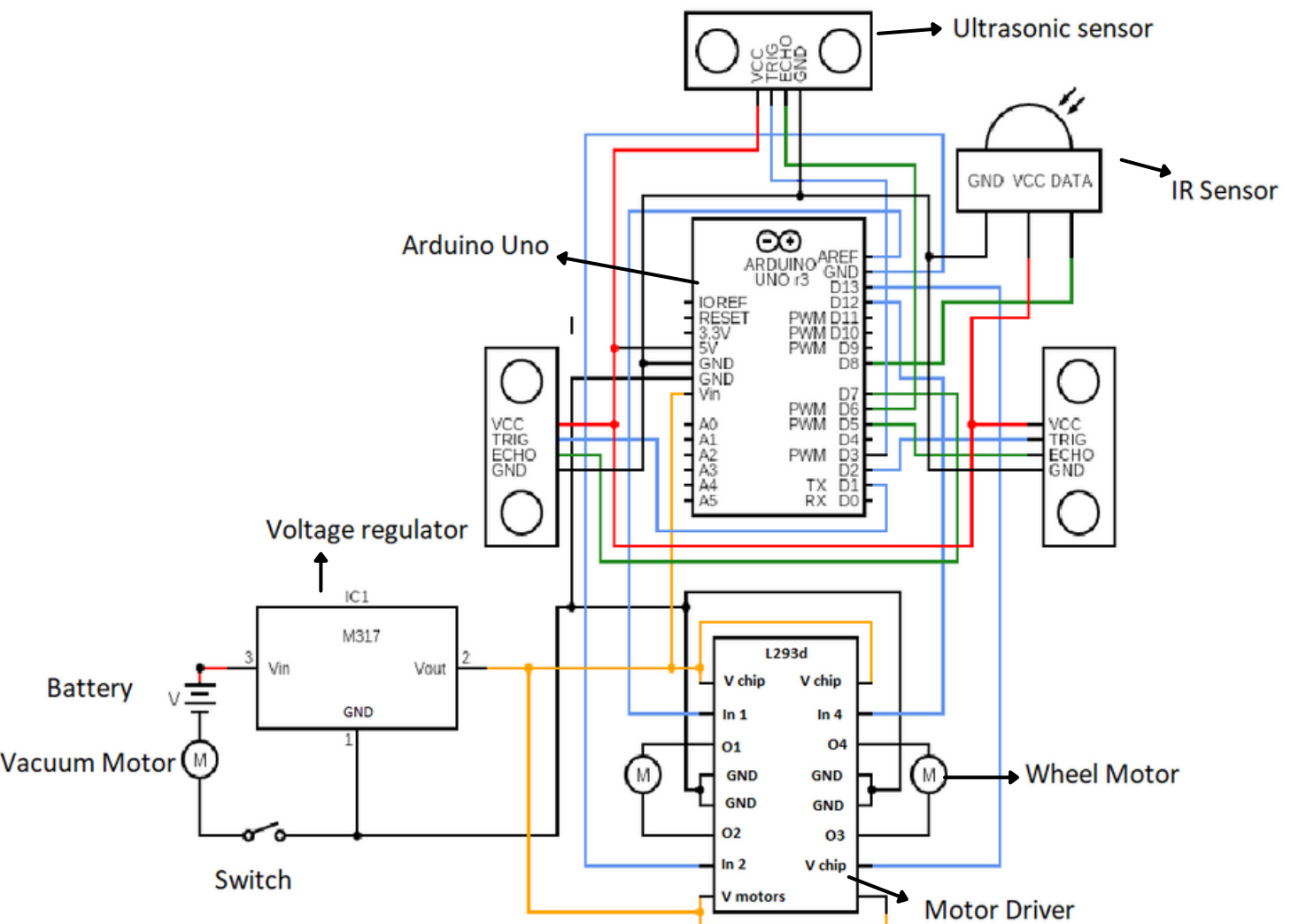

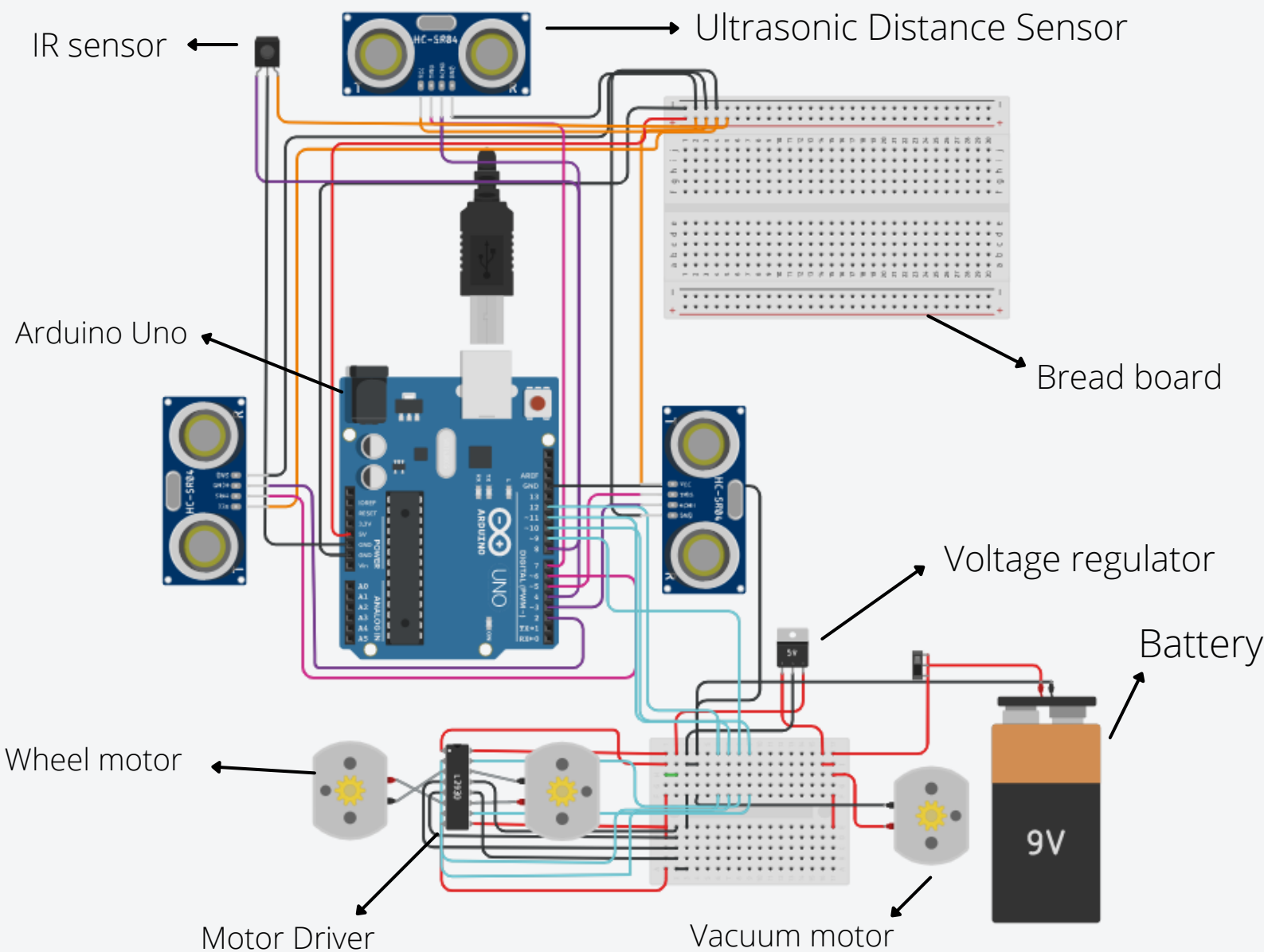**Finally completed the project with all the specification**

Team 2(ii)-prepared by jayewar shruti

FLOW CHART

Start

Vaccum fan motor start

The three ultrasonic sensors will calculate the distance of robot from object from left, right and front direction. *(Let x,y,z be respectively be front, left and right distance from object)*

The IR sensor will sense if robot is on the floor or at the edge of step

No at the edge

Yes on the floor

Move back

Then when IR sense the floor then robot rotate right

If (x>20 and y>20 and z>20) or (x>20 and y<=20 and z<=20)

YES → Move forward

NO

if (x<=20 and y<=20 and z>20) or (x>20 and y<=20 and z>20)

Yes → rotate right

NO

if (x<=20 and y>20 and z>20) or (x>20 and y>20 and z<=20) or (x<=20 and y>20 and z<=20)

YES → Rotate left

Team 2(ii)-prepared by Aryan Gupta

SCHEMATIC DIAGRAM

Ultrasonic sensor

IR Sensor

Arduino Uno

Voltage regulator

Battery

Vacuum Motor

Switch

Wheel Motor

Motor Driver

ARDUINO SIMULLATION DIAGRAM

IR sensor

Ultrasonic Distance Sensor

Arduino Uno

Bread board

Voltage regulator

Battery

Wheel motor

Motor Driver

Vacuum motor

9V

Detailed explanation: https://drive.google.com/file/d/181xeOivHfXO3HDTpegUeQQ8MYy6Onsz7/view?usp=sharing

Team 2(ii)-prepared by Aryan Gupta

SOURCE CODE

```
/* defining the triger and echo pins*/
const int trigerPin1 = 3;
const int echoPin1 = 5;
const int trigerPin2 = 6;
const int echoPin2 = 9;
const int trigerPin3 = 10;
const int echoPin3 = 11;
int irpin =2;
/* defining variables to store time taken by waves to come
back to sensor and distance travelled by the waves*/
long time1;
long time2;
long time3;
float left_distance;
float front_distance;
float right_distance;
int a=0;
void setup() {
  pinMode(trigerPin1, OUTPUT);
  pinMode(trigerPin2, OUTPUT);
  pinMode(trigerPin3, OUTPUT);/* Sets the trigerPin as an
 Output*/
  pinMode(echoPin1, INPUT); /* Sets the echoPin as an Input*/
```

Team 2(ii)-prepared by Aryan Gupta

```
pinMode(echoPin2, INPUT);
  pinMode(echoPin3, INPUT);
  pinMode(irpin, INPUT);
  pinMode(4, OUTPUT);
  pinMode(7, OUTPUT);
  pinMode(8, OUTPUT);
  pinMode(12, OUTPUT);
}
  void loop() {
  digitalWrite(trigerPin1, LOW);
  delayMicroseconds(2);
  digitalWrite(trigerPin1, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigerPin1, LOW);
  time1 = pulseIn(echoPin1, HIGH);
  left_distance = time1 * 0.034 / 2;/*Since distance travelled by
the waves is twice the distance between object and ultrasonic
sensor*/
  Serial.print("Distance1: ");
  Serial.println(left_distance);
  digitalWrite(trigerPin2, LOW);
  delayMicroseconds(2);
  digitalWrite(trigerPin2, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigerPin2, LOW);
  time2 = pulseIn(echoPin2, HIGH);
  front_distance = time2 * 0.034 / 2;
  Serial.print("Distance2: ");
  Serial.println(front_distance);
  digitalWrite(trigerPin3, LOW);
```

```
delayMicroseconds(2);
  digitalWrite(trigerPin3, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigerPin3, LOW);
  time3 = pulseIn(echoPin3, HIGH);
  right_distance = time3 * 0.034 / 2;
  Serial.print("Distance3: ");
  Serial.println(right_distance);
  int s = digitalRead(irpin);/*Check whether the robot is on the
floor or aqt the edge of step*/
  if(s==HIGH)/*Condition for moving back*/
  {
    digitalWrite(4, LOW);
    digitalWrite(7, HIGH);
    digitalWrite(8, LOW);
    digitalWrite(12, HIGH);
      delay(1000);
    a=1;
    }
  if ((a==0)&&(s==LOW)&&(left_distance <= 20 && front_distance
> 20 && right_distance <= 20) || (a==0)&&(s==LOW)&&
(left_distance > 20 && front_distance > 20 && right_distance >
20)) /*Condition for moving forward*/
  {
    digitalWrite(4, HIGH);
    digitalWrite(7, LOW);
    digitalWrite(8, HIGH);
    digitalWrite(12,LOW);
  }
```

```
if ((a==1)&&(s==LOW)||(s==LOW)&&(left_distance <= 20 &&
front_distance <= 20 && right_distance > 20)||(s==LOW)&&
(left_distance <= 20 && front_distance <= 20 && right_distance
> 20)||(s==LOW)&& (left_distance <= 20 && front_distance > 20
&& right_distance > 20)||(left_distance <= 20 && front_distance
> 20 && right_distance > 20))/*Condition for moving right*/
  {
    digitalWrite(4, HIGH);
    digitalWrite(7, LOW);
    digitalWrite(8, LOW);
    digitalWrite(12, HIGH);
    delay(100);
    a=0;
  }
  if ((s==LOW)&&(left_distance > 20 && front_distance <= 20 &&
right_distance <= 20) ||(s==LOW)&& (left_distance > 20 &&
front_distance > 20 && right_distance <= 20) ||(s==LOW)&&
(left_distance > 20 && front_distance <= 20 && right_distance >
20) ) /*Condition for moving left*/
  {
    digitalWrite(4, LOW);
    digitalWrite(7, HIGH);
    digitalWrite(8, HIGH);
    digitalWrite(12, LOW);
  }
}
```

HARDWARE SETUP
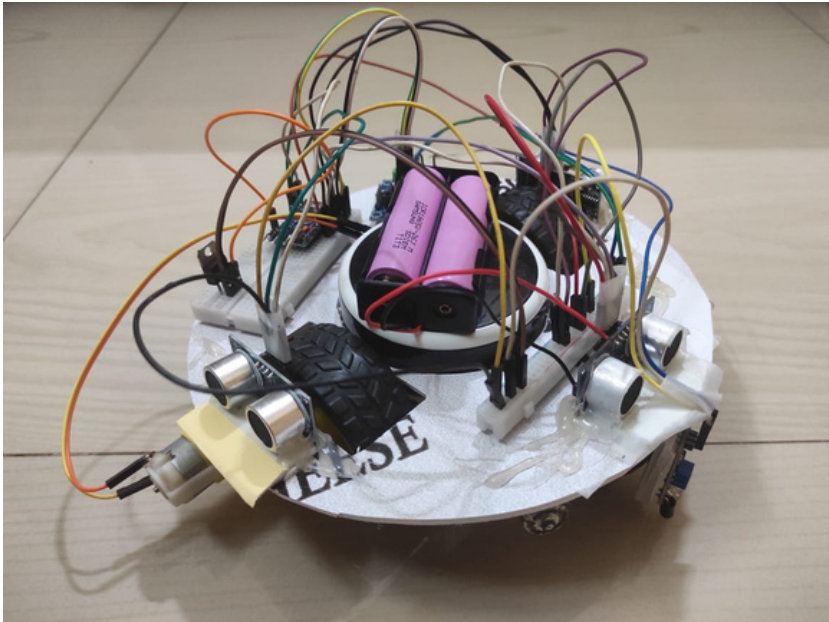
- In the middle there is the vacuum cleaner which cleans the floor following the set of protocols which are written in the Arduino

- The three Ultrasonic sensors on the three different sides is to save the robot from any sort of crash with obstruction.
- The IR sensor you can see is to save the robot from falling from a height, like from stairs or from table top
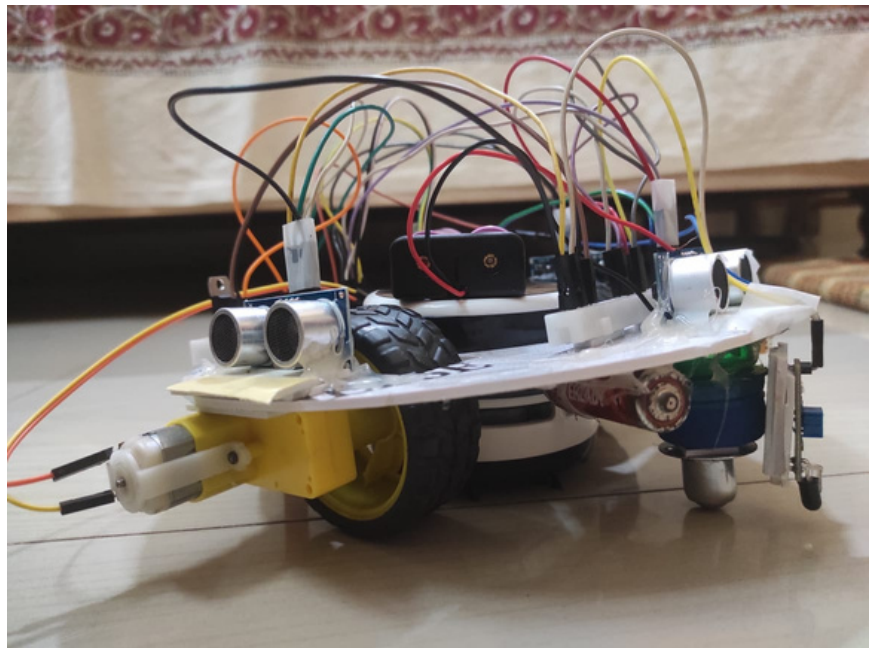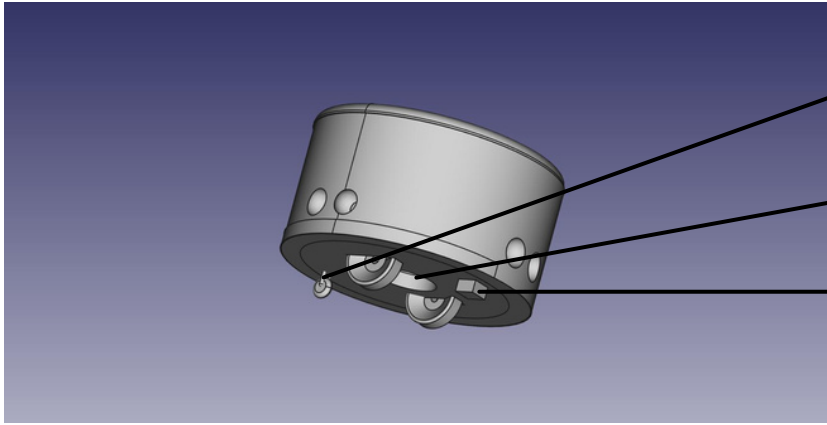
HARDWARE SETUP
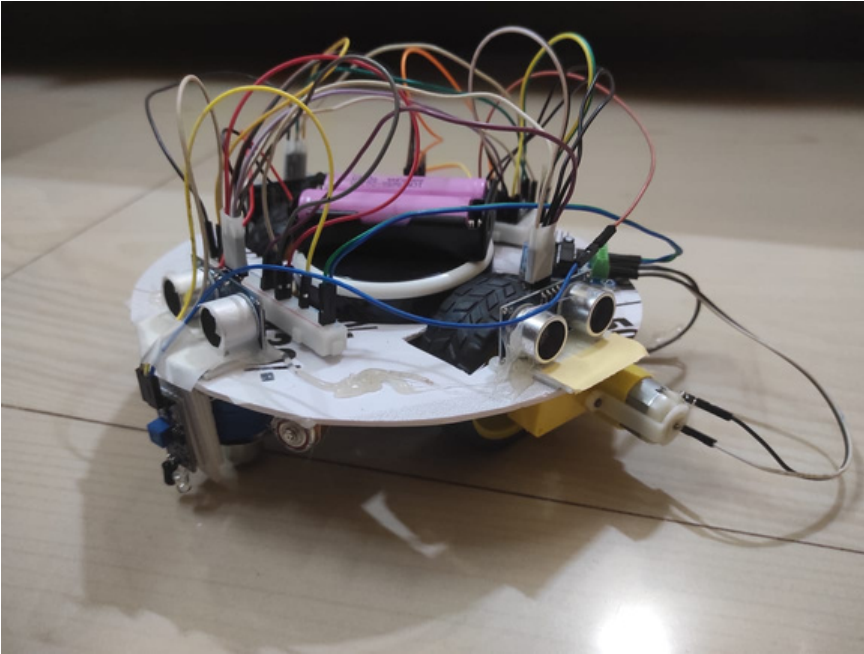
- The robot is responding properly with the help of IR sensor when the robot is lifted up to a certain height. We observe same thing as shown in simulation.
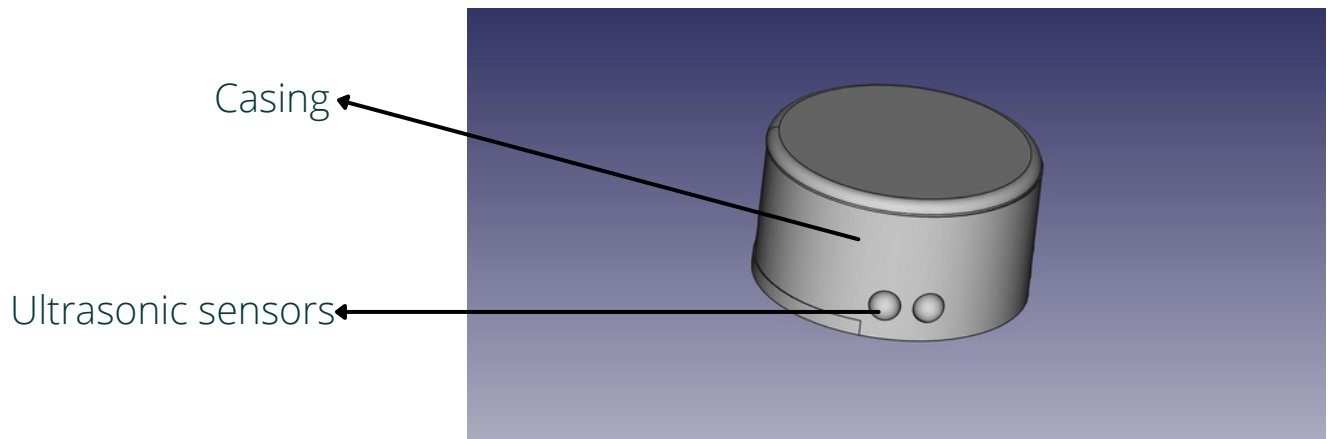
We have used two spare batteries to counter weight the weight of the breadboard , Arduino and the motor driver

Issues: The ultrasound sensors are not working for some reason which we still aren't able to identify properly. We have checked the ultra sound sensors individually to see whether they are faulty but no fault was detected. We even checked whether the voltage is getting supplied to the ultrasonic sensor using multimeter, still nothing suspicious was detected. We are really clueless about what could be the case. We have even tried to change the code, yet we failed to identify. Due to the time constraint we would like to submit it.
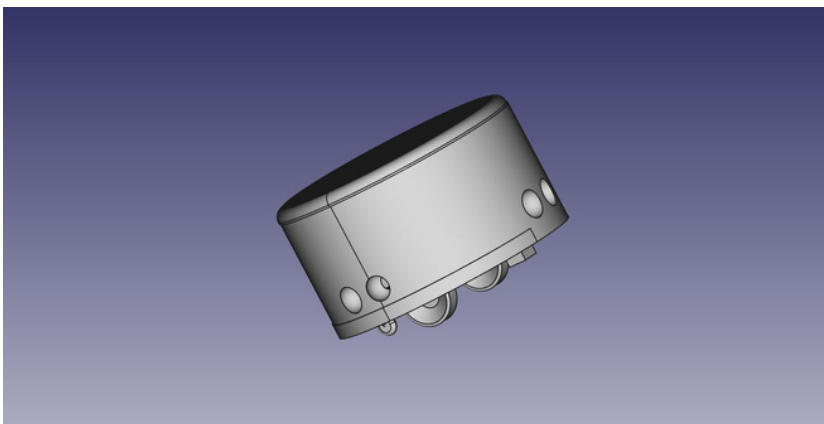
FREE CAD MODEL

Castor wheel

Vacuum cleaner will fit in

IR senor

FRONT VIEW

Casing

Ultrasonic sensors

SIDE VIEW

The link for the video is :
https://drive.google.com/drive/folders/1bE84Dxi7I8l7PvSLsKcyUfzyYMFEUg4r

Team 2(ii)-prepared by Jayewar Shruti

WORK SHARING

We were a group of 4 members and have worked smoothly with all the team members. Everyone was very coperative and completed their responsibilities assigned timely.

ARDUINO PROGRAMING

The Arduino Programming has been been created and perfected by Aryan Gupta .

SIMULATION

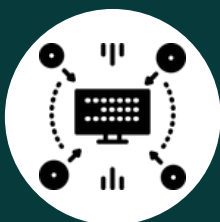The simulation has been done and perfected on Tinkercad by Aryan Gupta .

ASSEMBLING MODEL

Assembling all the parts used in making Robotic Vacuum Cleaner and the overall hardware setup has been done by Sohini Gupta.

FREE CAD MODEL

The Freecad model has been done and perfected by Jayewar Shruti and Akash Paswan.

COMPILATION

Overall compilation and the Report Writting has been done by Akash Paswan.
Presentation making had a contribution of all the team members

Overall supervision was done by Sohini Gupta.

CONCLUSION AND IMPROVEMENT

The project has been successfully finished with a great team work. Hardware setup and source code has been tested successfully. The model is working smoothly. However it needs some modification to make it real world compatible. We can improve on this model by controlling the robot distantly through an application in your phone. The robot will give indication to the app when it is full, i.e. no longer it can take in dust particles and also when the robot is idle for some time, i.e. when the floor is already cleaned so that we can switch off the robot and prevent unnecessary battery consumption. Since we have limited resources, time and hence knowledge, we tried to make the model affordable and efficient within the limits.

ACKNOWLEDGEMENTS

We would like to take this opportunity to express our thanks and gratitude to our professors conducting the DIY course for giving us the opportunity to learn about Arduino software, Free CAD and Tinkercad. We would also like to thank our parents for all their support during the making of the project. We have learned a lot of new technologies during this project and overall it was a great experience.

References

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- https://web.stevens.edu/ses/me/fileadmin/me/senior_design/2007/group01/DesignFinal.pdf
- https://www.instructables.com/Floor-vacuum-cleaner-robot-controlled-by-Arduino-w/
- https://people.ece.cornell.edu/land/courses/ece4760/FinalProjects/s2006/hac24/index.htm
- https://portfolio.id.utwente.nl/student/westenbroekj/verslagen/Verslag.pdf

Link for google drive :

- https://drive.google.com/drive/folders/1bE84Dxi7I8l7PvSLsKcyUfzyYMFEUg4r?usp=sharing